



# **Armed Forces College of Medicine AFCM**



# **Embolism**

***Presented by  
Prof. Wesam M. Osman***

# INTENDED LEARNING OBJECTIVES (ILO)



**By the end of this lecture the student will be able to:**

- 1. List different types of emboli**
- 2. Recognize the pathology of thromboembolism  
(aetiology ,sites and effects)**
- 3. Outline briefly the pathology of the unusual types of  
Embolism (fat- amniotic fluid-air)**

# Lecture Plan



- 1. Types of Embolism (5 min)**
- 2. Thromboembolism (pathogenesis/clinical picture and diagnosis) (20 min)**
- 3. Unusual types of embolism (20 minutes )**
- 4. Lecture Quiz (5 min)**

# Embolism

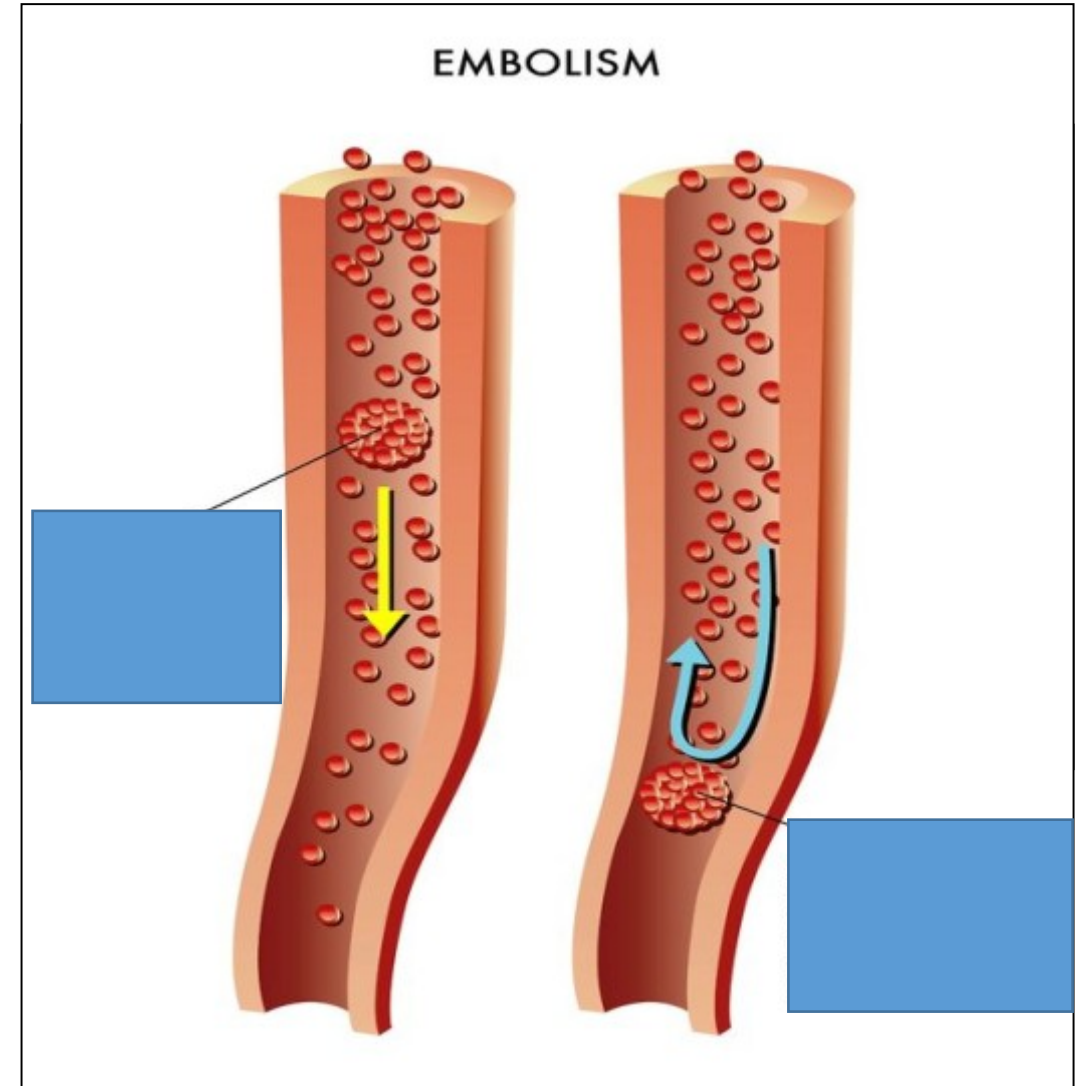


## ❖ An embolus

An insoluble mass (solid, liquid, or gaseous) circulating in the blood stream



too small to allow its further passage



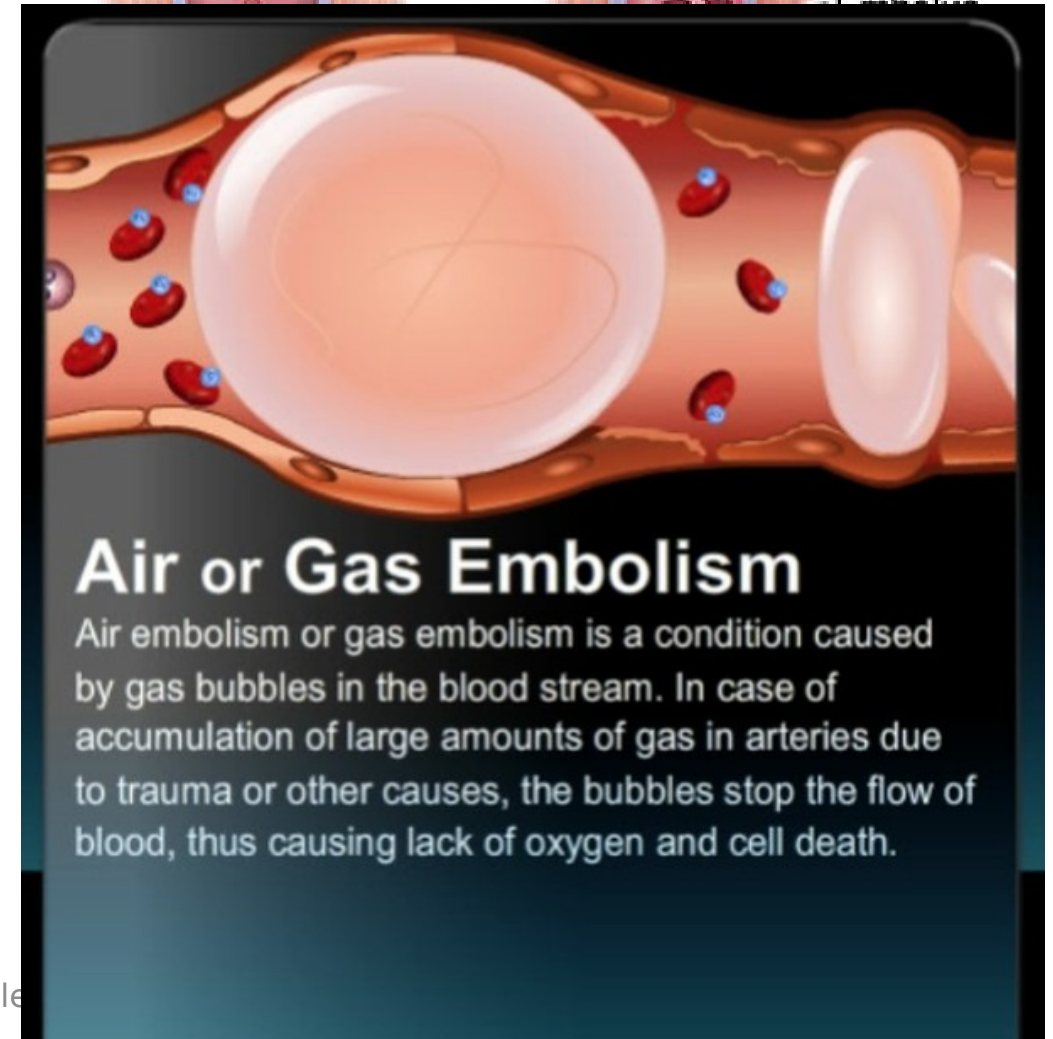
# Embolism



<https://clipartstation.com/overcoming-challenges-clipart-5/>

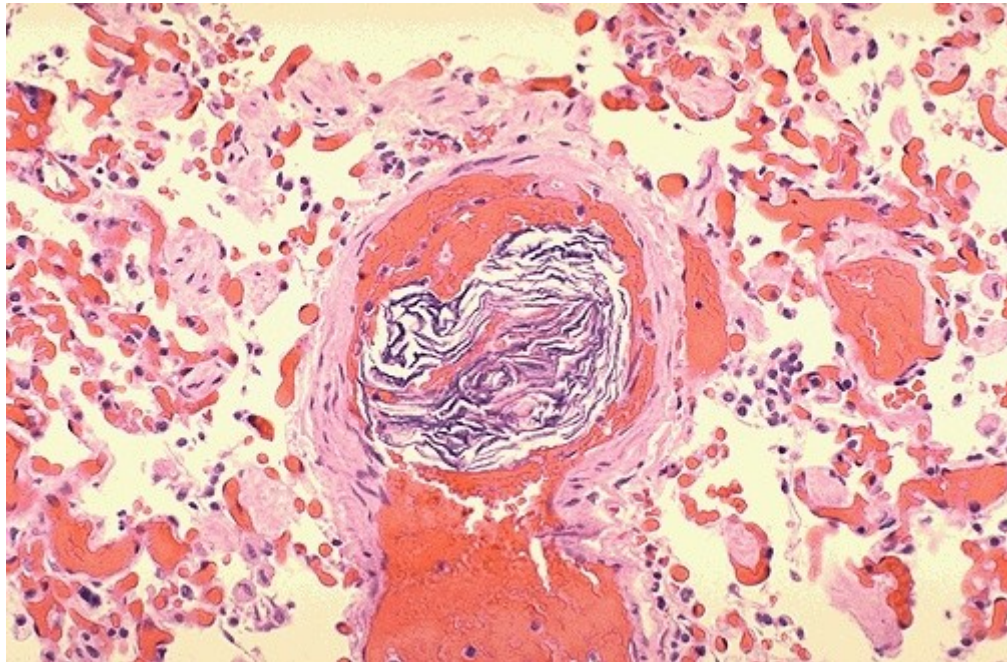
09/11/2024

(Cardiopulmonary Module)





# Amniotic fluid Embolism

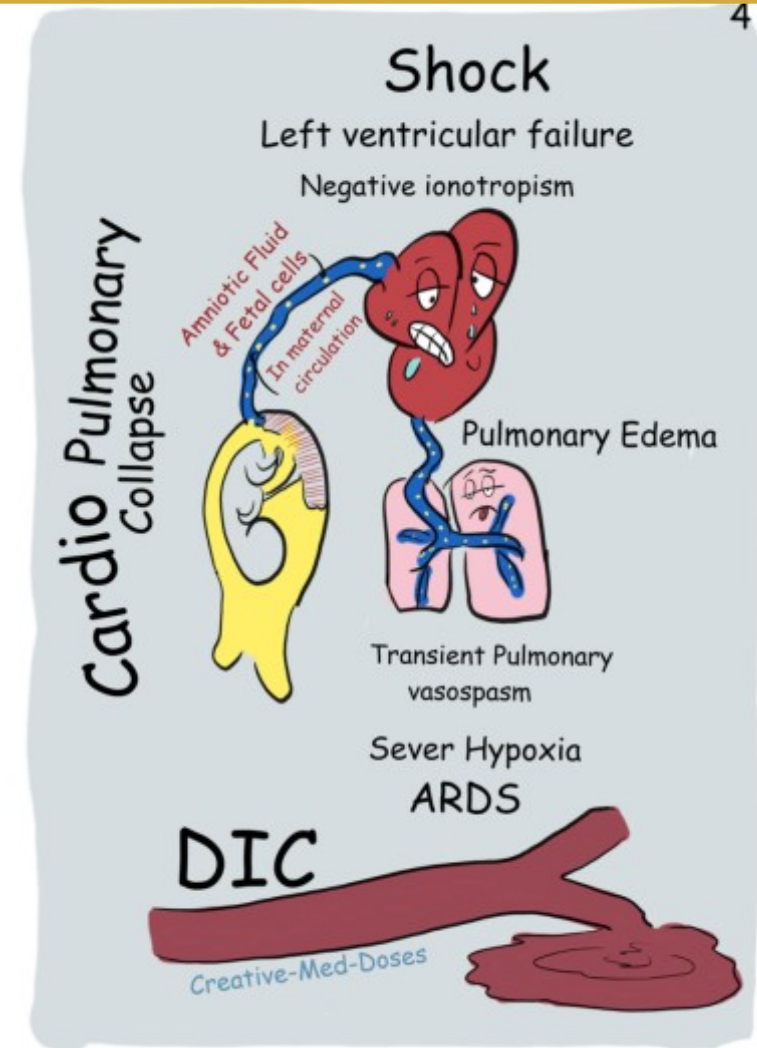


<https://webpath.med.utah.edu/FORHTML/FOR090.html>

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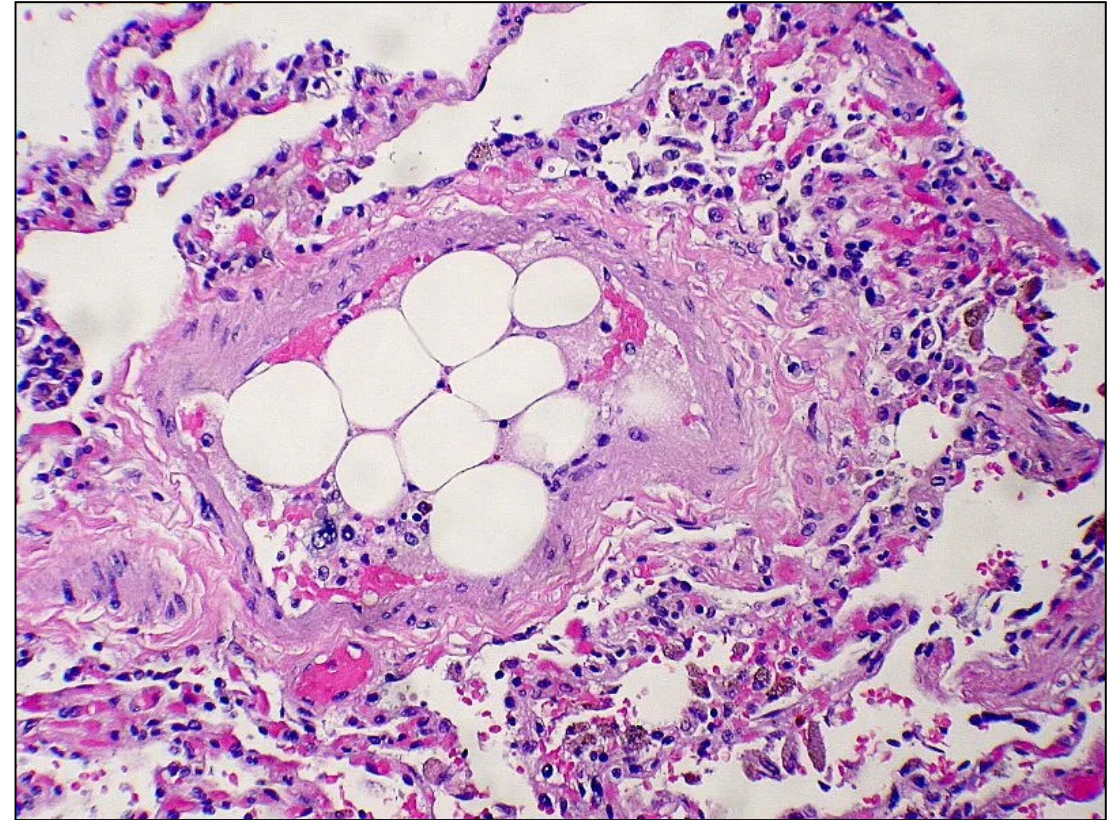
<https://creativemeddoses.com/topics-list/amniotic-fluid-embolism/>



# Fat Embolism



<https://notesread.com/fat-embolism/>



[https://i0.wp.com/www.pathologystudent.com/wp-content/uploads/2012/12/800px-Bone\\_marrow\\_embolus.jpg?ssl=1](https://i0.wp.com/www.pathologystudent.com/wp-content/uploads/2012/12/800px-Bone_marrow_embolus.jpg?ssl=1)



# 1. Thrombo-embolism

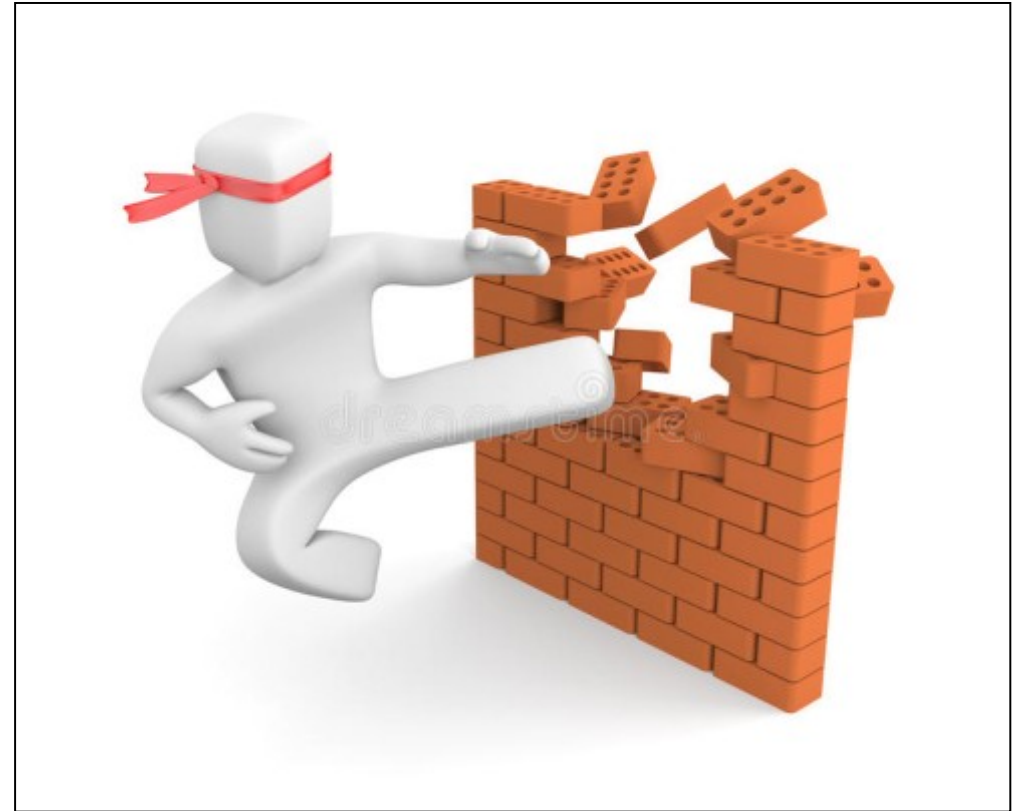


## **Aetiology**

**Fragmented or detached thrombi**

## **Sites of impaction of the emboli**

- A. Pulmonary artery**
- B. Portal vein radicles**
- C. Systemic arteries**
- D. Paradoxical**



<https://www.dreamstime.com/stock-photography-breaking-barriers-people-action-metaphor-separated-white-image32841442>

# A. Pulmonary embolism

## Source and course

### ❖ Emboli derived from thrombi of:

- **Systemic veins**

venae cava



the heart

reach the

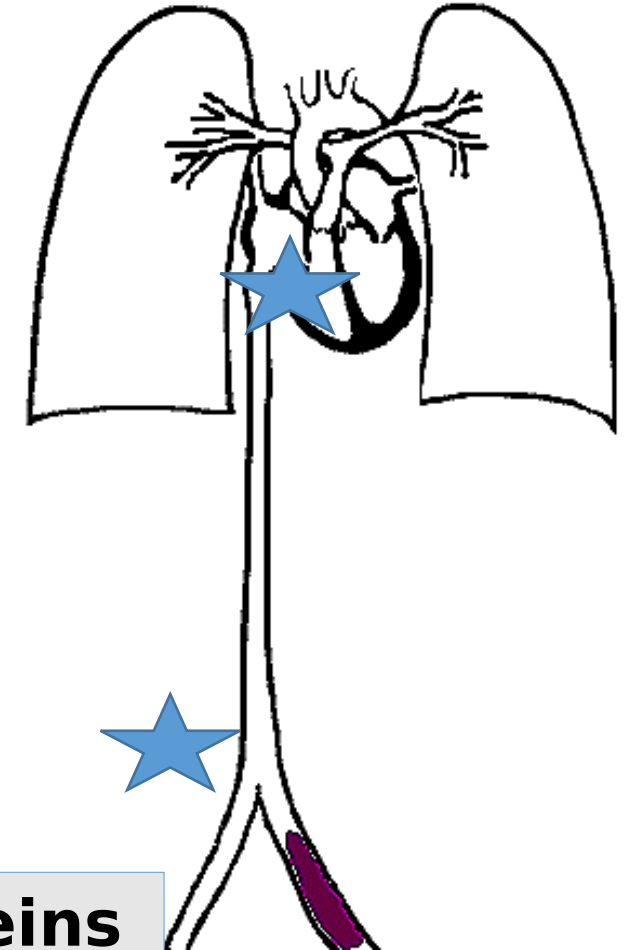
Rt. Side of



- **Right side of the heart**

### ❖ Become impacted in pulmonary arteries

**Thrombus in systemic veins**



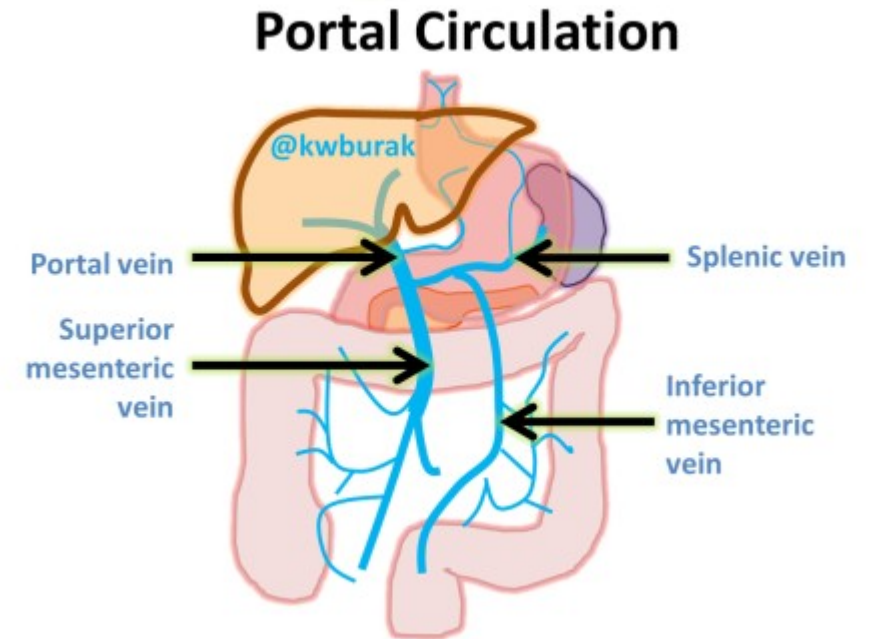
# B. Portal embolism



**Emboli are**

❖ **Derived from thrombi of the Mesenteric or Splenic veins**

❖ **impacted in the portal vein radicles**



[https://pbs.twimg.com/media/CpwtipBVMAEW4a\\_.png](https://pbs.twimg.com/media/CpwtipBVMAEW4a_.png)

# C. Systemic embolism

**Emboli** are

❑ Derived from thrombi of

- **Pulmonary veins**
- **Heart** (left atria, left sided valves, left ventricle)
- **Aorta**

❑ Circulate in systemic arterial circulation

❑ Impacted in different sites as cerebral, renal, splenic & hepatic



**Important Notice**



# D. Paradoxical embolism



## Emboli circulating in systemic veins

- ❑ may not cause pulmonary embolism
- ❑ instead lead to systemic embolism

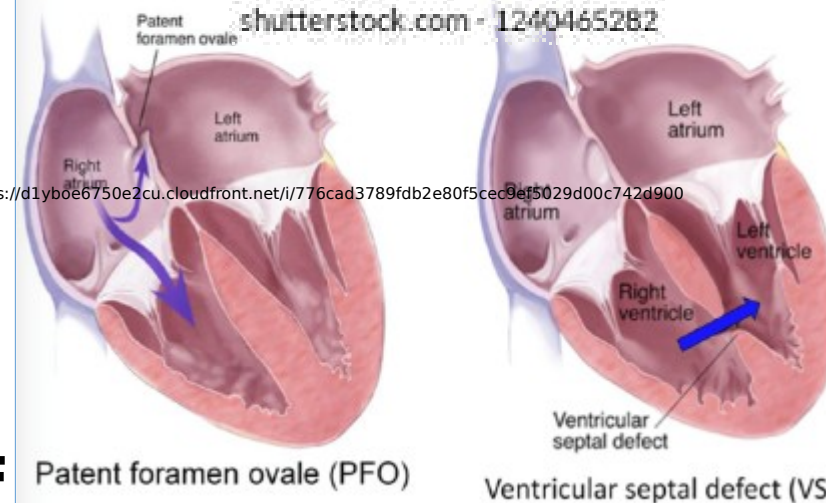
## Mechanisms

- ❑ Very small emboli may by-pass the pulmonary capillaries and reach left side of the heart
- ❑ Emboli pass from right to left side of



<https://www.shutterstock.com/search/paradoxical>

A "Paradoxical embolus" travels from the venous to the systemic circulation



<https://d1yboe6750e2cu.cloudfront.net/i/776cad3789fdb2e80f5cec3e5029d00c742d900>



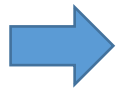
# Effects of thrombo-embolism



## A) Septic emboli

Derived from

- ❑ Septic thrombi as in septic thrombophlebitis



**embolism**

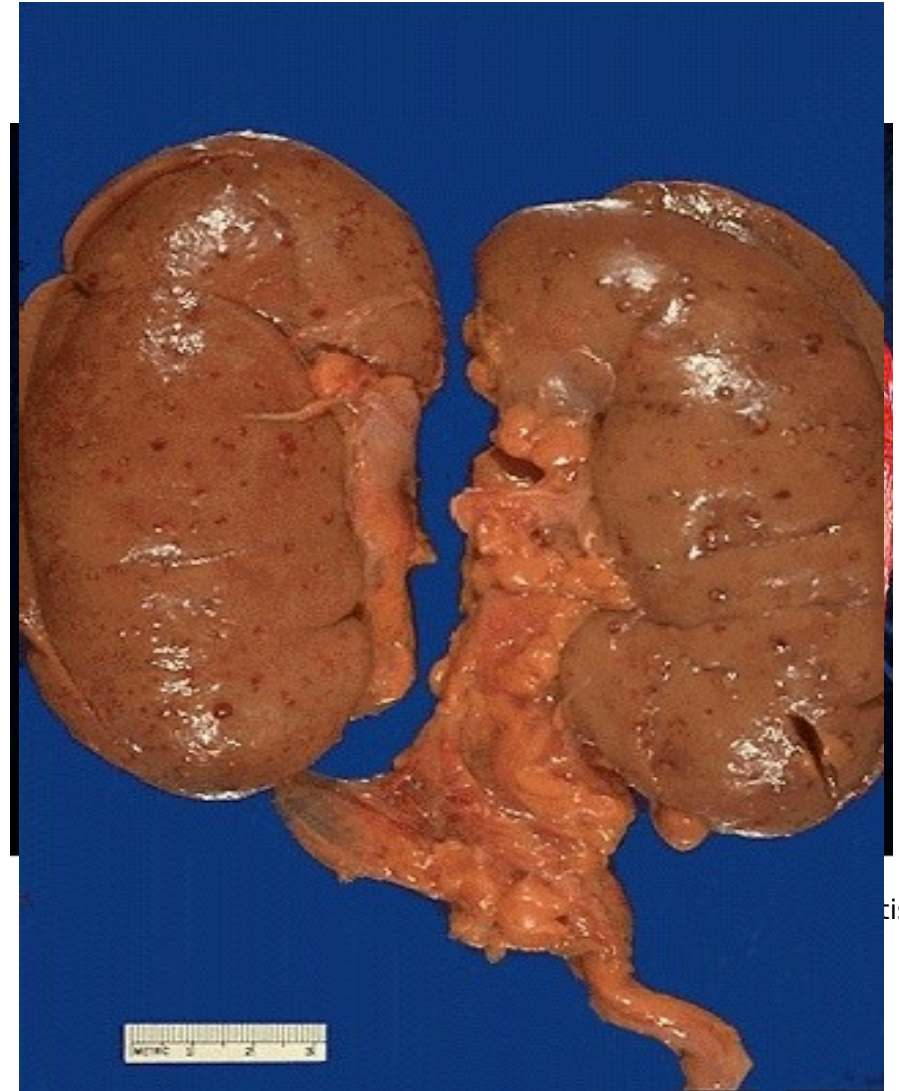
- ❑ Septic vegetation as in acute bacterial endocarditis



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**Pyæmic abscesses**



<https://webpath.med.utah.edu/RENAHTML/RENAL015.html>

# Effects of thrombo-embolism



## **B) Aseptic emboli (in general)**

- ❑ Occlusion of arteries with **poor collaterals**



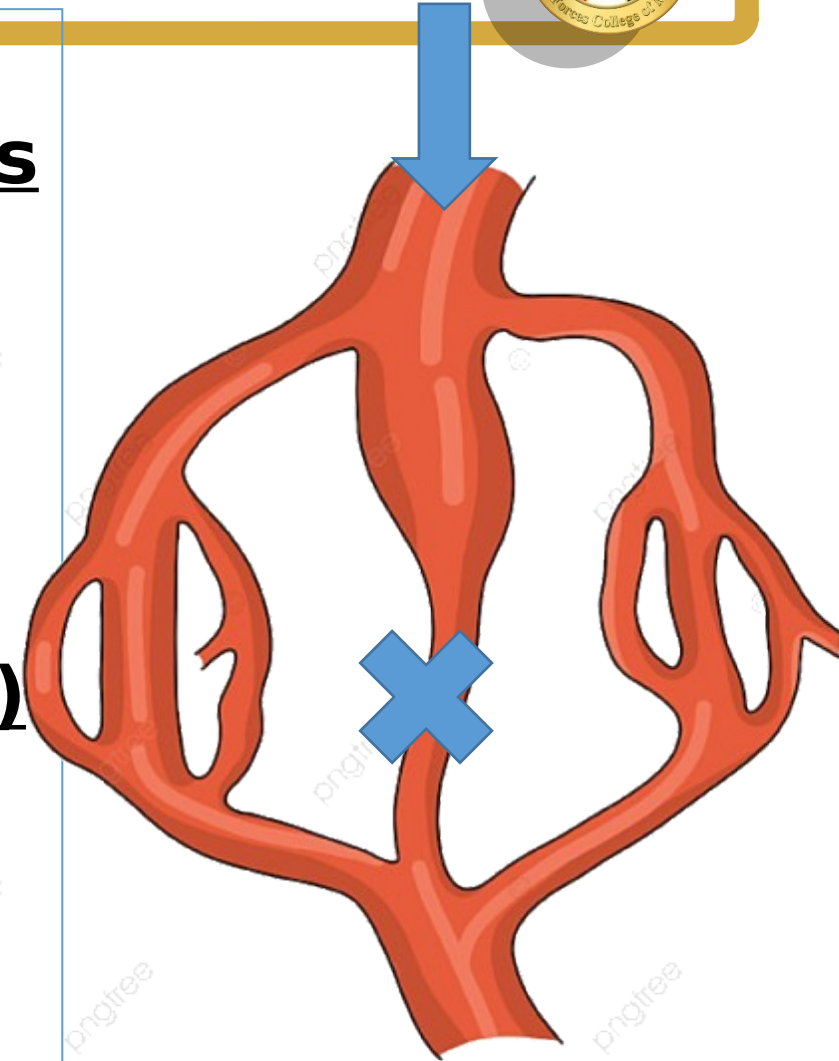
**Infarction or**

**gangrene**

- ❑ Occlusion of arteries with **good (efficient)** **collaterals**



**No effect**

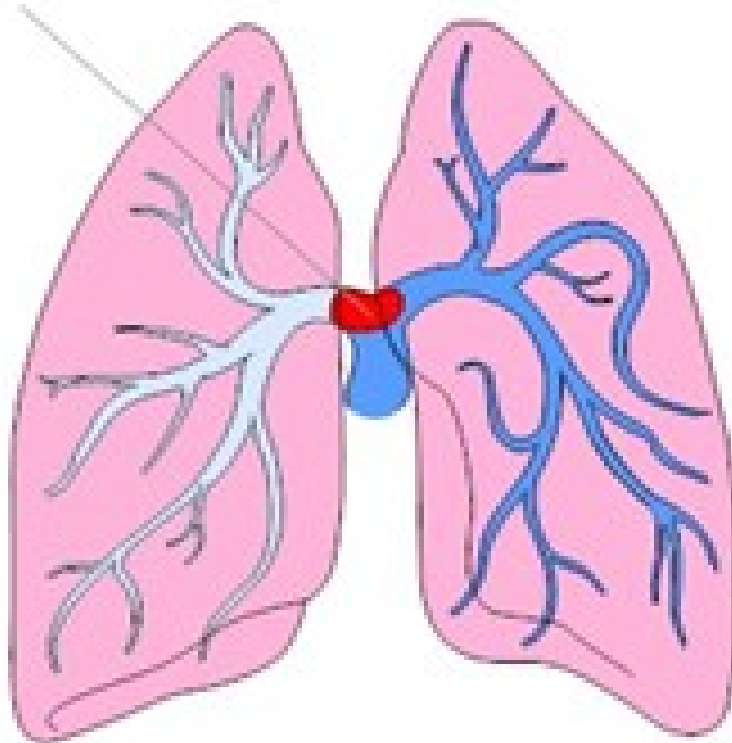


[https://pngtree.com/freepng/cardiology-arterial-trunk-and-collateral-illustration\\_618](https://pngtree.com/freepng/cardiology-arterial-trunk-and-collateral-illustration_618)

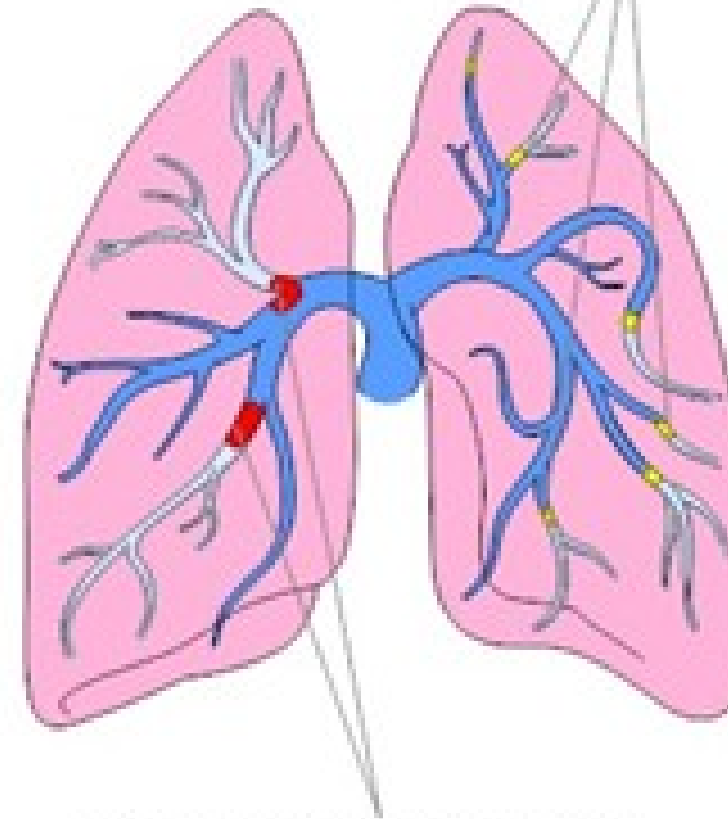
# Effects of thrombo-embolism



Pulmonary embolism in main pulmonary artery



Multiple emboli in small branches of pulmonary artery



Pulmonary emboli in main branches of pulmonary arteries

# Effects of thrombo-embolism



## Effects of aseptic emboli in pulmonary embolism:

Impacted in the ***main pulmonary trunk or the main pulmonary branches*** → massive pulmonary embolism → acute heart failure → sudden death.

**1- Large emboli**

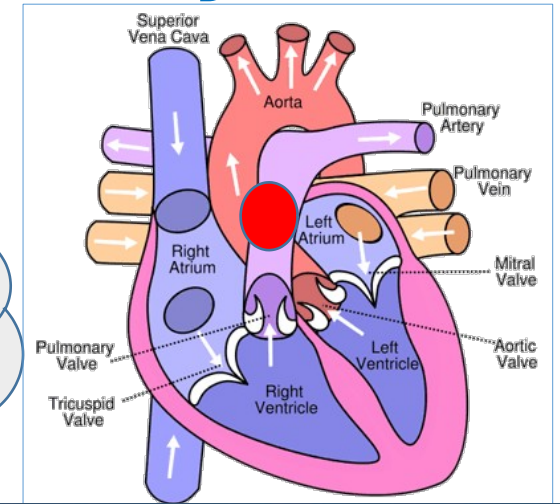


Fig. 4-12 Embolus derived from a lower-extremity deep venous thrombus

## Mechanism

- ❑ Obstruction of blood out flow from right ventricle
- ❑ Vasoconstriction of pulmonary arterioles due to serotonin released from platelets of the large embolus

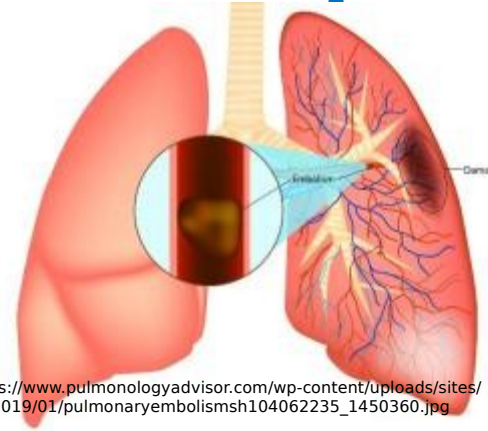


# Effects of thrombo-embolism



## Effects of aseptic emboli in pulmonary

**embolism?**  
**Medium  
sized  
emboli**



**3-Very  
small  
emboli**

Impacted in **medium -sized & small  
branches**

☐ With **good (efficient)** collateral (bronchial artery) →  
**no effects**

☐ may have no  
effect

or

☐ cause  
paradoxical  
embolism ????

☐ With **poor** collateral (inadequate bronchial



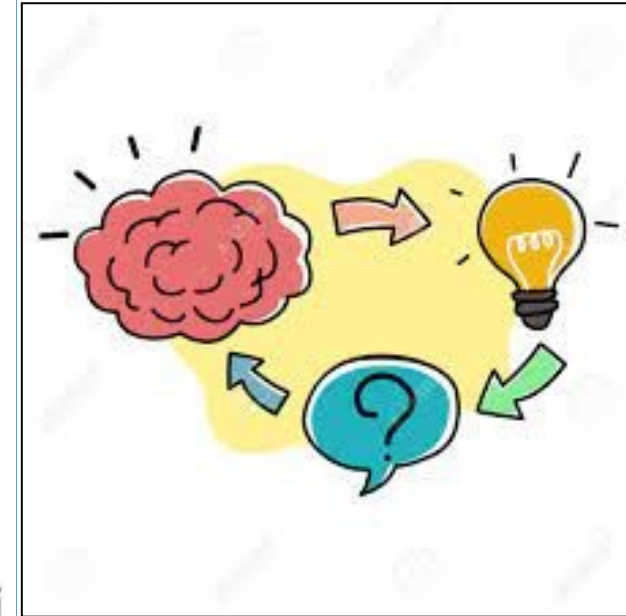
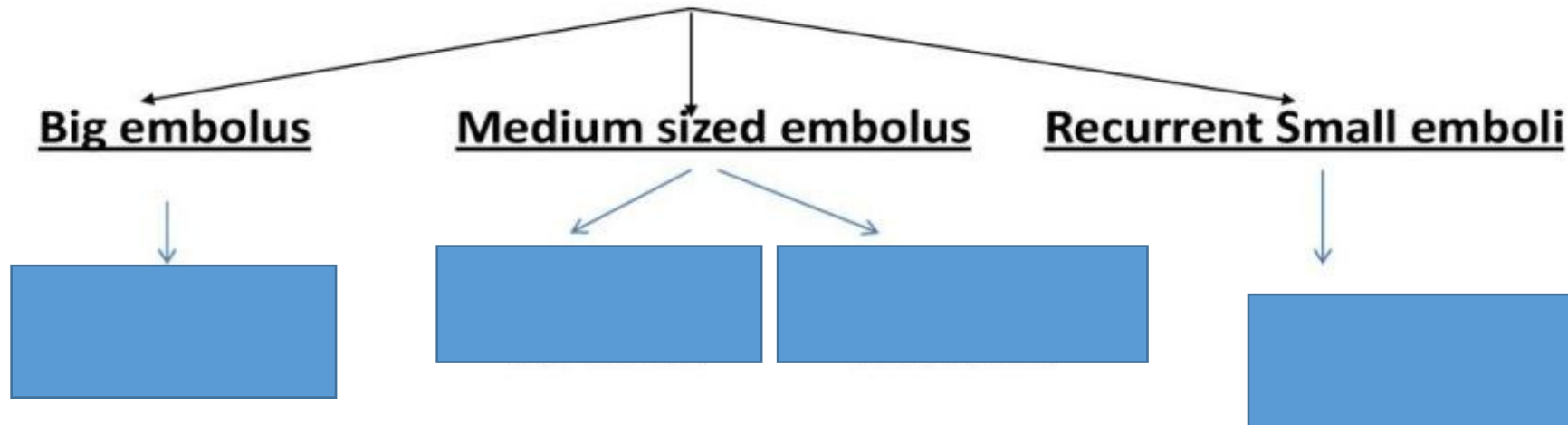
# Effects of thrombo-embolism



- Effects depends upon:

- 1- Size of the embolus.
- 2- Nature of the embolus (septic or aseptic).
- 3- State of the collateral circulation in the affected site.

- Effects of pulmonary embolism:



[https://www.123rf.com/photo\\_51310339\\_process-of-thinking-info-graphic-car](https://www.123rf.com/photo_51310339_process-of-thinking-info-graphic-car)

# ***Thromboembolism (Quiz)***



**What is the origin of a large embolus impacted in a medium sized pulmonary artery?**

- A. Mesenteric artery thrombus
- B. Splenic vein thrombus
- C. Left ventricle thrombus
- D. Leg vein thrombus
- E. Aortic thrombosis

## 2. Fat embolism

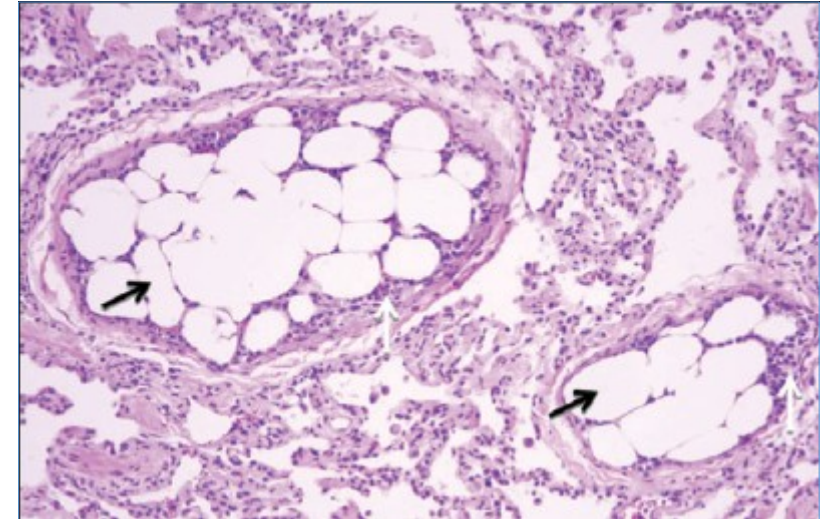


### Aetiology

Minute fat globules reach the pulmonary circulation (pulmonary fat embolism) in case of



- ☐ Fracture of long bones (**Most common**); bone marrow fat may reach circulation through injured vessels.
- ☐ Orthopedic surgery
- ☐ Liposuction
- ☐ Severe burns



<https://d3i71xaburhd42.cloudfront.net/2094e4fdac376a0ada917061e8cba4e0076d2627/3-Figure2-1.png>

Bone marrow embolus composed of hematopoietic marrow and marrow fat cells (clear spaces)

## 2. Fat embolism



### Effects

### Fat embolism syndrome

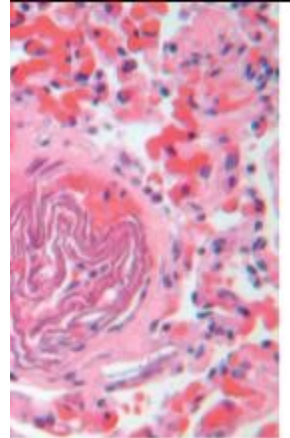
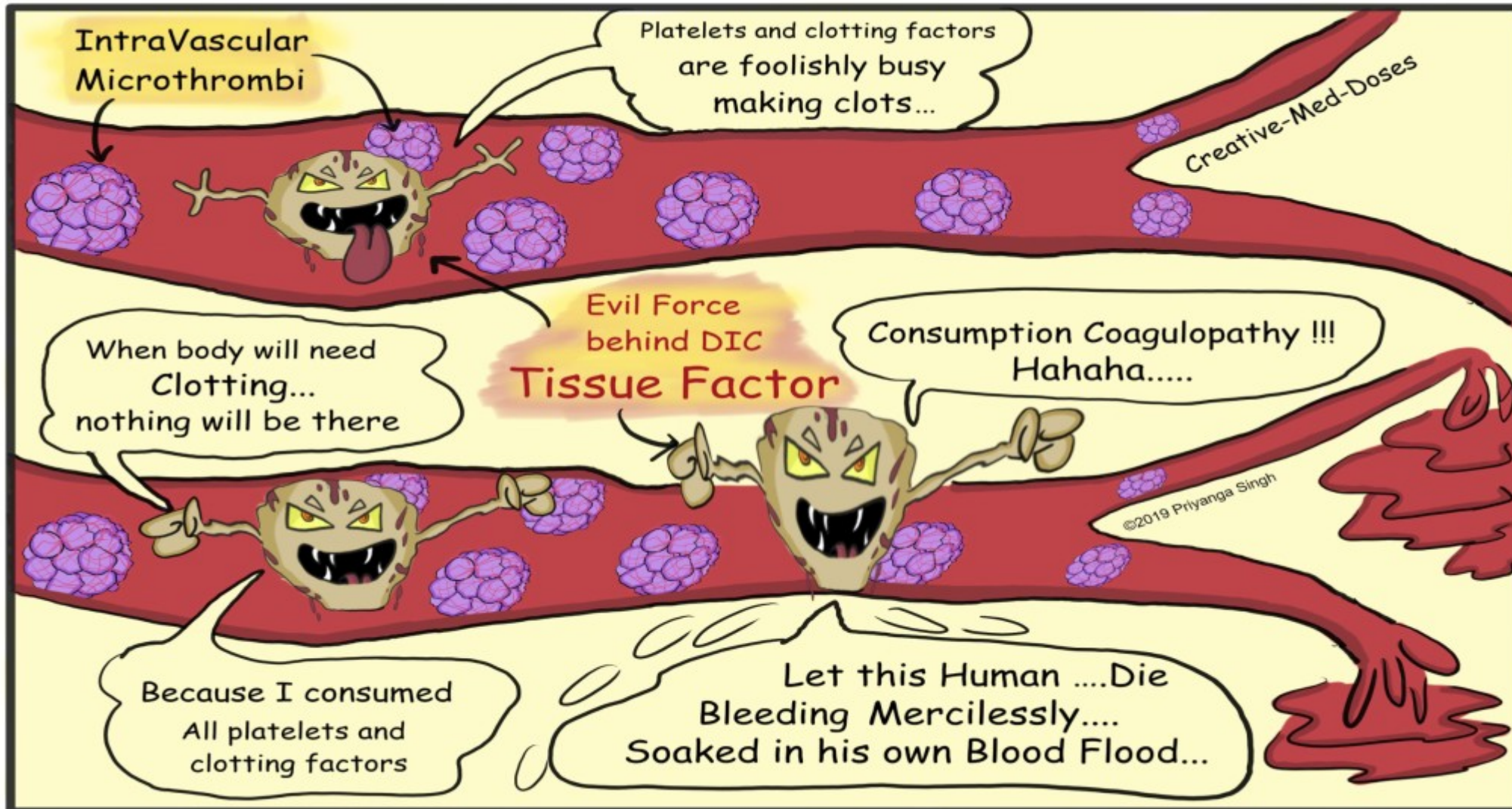
- Occur 1-3 days after injury, Emboli reach pulmonary and cerebral blood vessels
- Fatal in 10% of cases.

### Fat Embolism Syndrome





# 3. Amniotic fluid embolism



Amniotic fluid emboli. Two small pulmonary arteries containing fetal squamous cells. The surrounding tissue is congested. (Courtesy of Dr. Beth Schwartz, MD)

ins

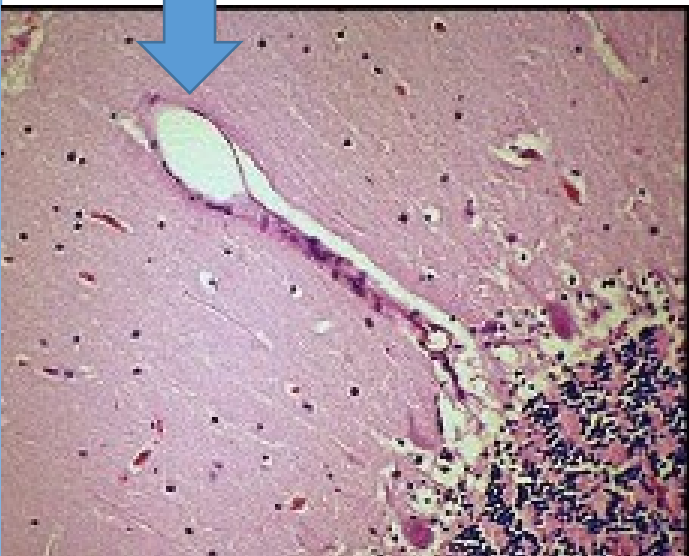
on



# 4. Gas (air) embolism



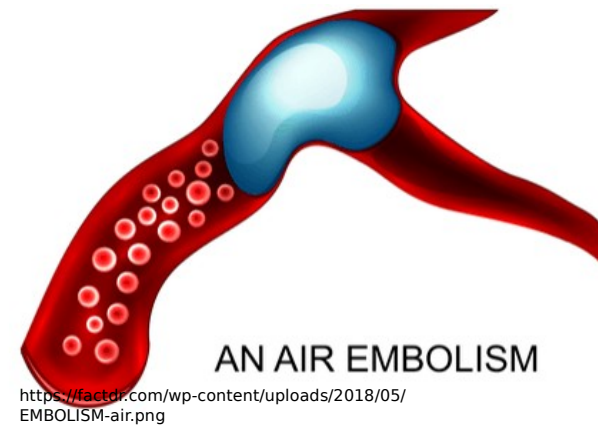
**A-Single embolism** Gas bubbles within the circulation coalesce and obstruct the flow resulting in ischemic injury  
e.g. injury of **a neck vein** by stab wound, **coronary vessels** during bypass surgery, **cerebral vessels** during neurosurgery, and **Obstetric or laparoscopic** procedures



Gas bubbles reach the venae cavae

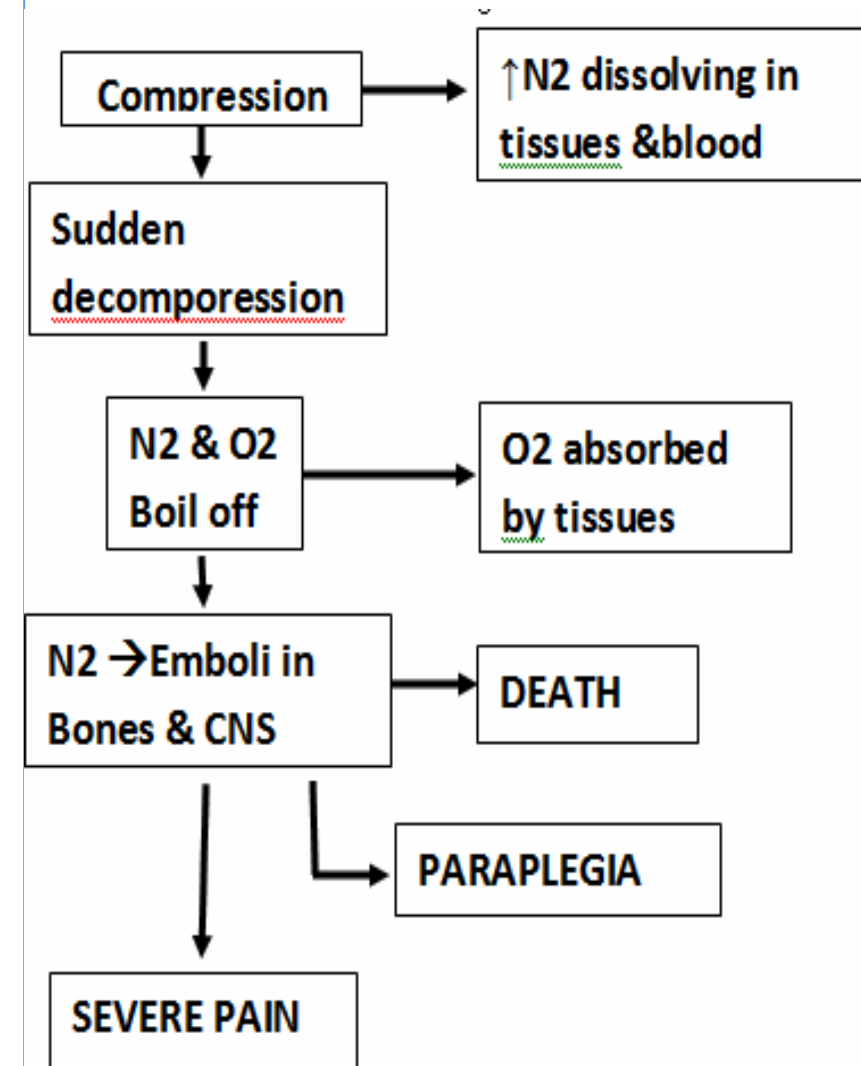
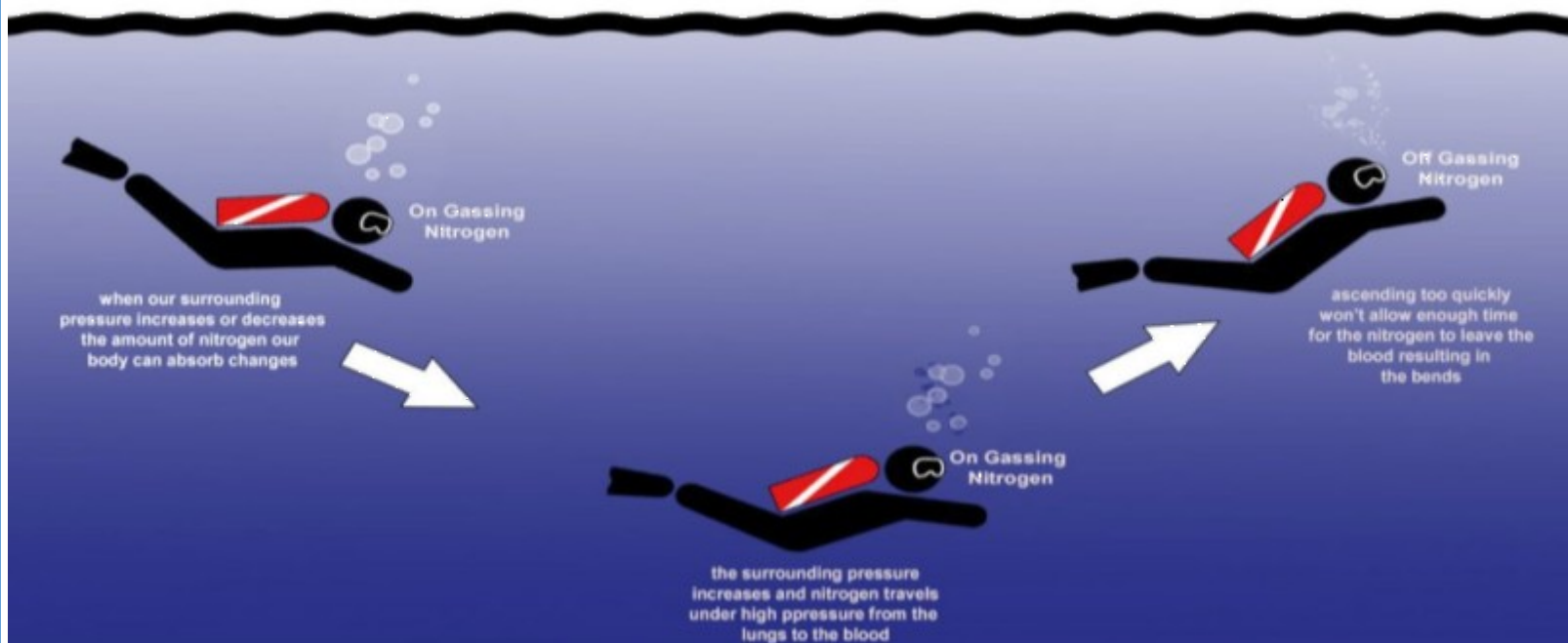
Right ventricle frothing

Serious impairment of cardiac action



# 4. Gas (air) embolism

- It occurs in **Caisson disease** or **decompression sickness** due to sudden changes in atmospheric pressure
- E.g. Scuba divers, workers in underwater construction & unpressurised crafts



## ***Unusual types of embolism (Quiz)***



**A young diver descended in deep sea. After 30 minutes he ascended rapidly because he forgot to get his camera. He soon experienced difficulty in breathing, severe headache, pain in muscles & joints. These symptoms are due to:**

- A. Disseminated intravascular coagulation
- B. Systemic vasodilatation
- C. Venous thrombosis
- D. Gas emboli
- E. Fat globules in arterioles

## ***Key points:***



- Embolism is impaction of the embolus in a blood vessel which is too small to allow its further passage
- The most common type of emboli is thromboemboli
- Sites of impaction of the emboli are pulmonary artery, portal vein radicles, systemic arteries & paradoxical
- The most common cause for fat emboli is fracture of long bones
- Amniotic fluid embolism is a rare, but fatal condition
- Gas emboli may be single or multiple (Casisson's disease)

# Suggested textbooks



**1. Robbins basic pathology, 10<sup>th</sup> Edition.**

**Pages: 112-114**

**2. [https://](https://webpath.med.utah.edu/webpath.html)**

**[webpath.med.utah.edu/webpath.html](https://webpath.med.utah.edu/webpath.html)**



